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Abstract The purpose of this chapter is to approach the concept of writing style in a new way. Style is defined in the cutting edge of ecological perception and physical biology, such that self-sensitivity and self-assembly are the leading concepts. Based on this definition it is stated that a method of analysis should be founded on non-linear dynamics. Consequently, a study of textual geometry is set up that is founded on the AaO-axiom. The materials used for the experiment has been an ancient roman text by Tacitus. The result confirms the common characteristics of the writing style of Tacitus. In addition it has been evident that the method was able to differentiate the intentional (Agent) from the orientational (Objective) component of the text. In conclusion, Tacitus was writing with a personal perspective; the flow dynamics of his Agent is lively. However, the dynamics of the Objective has a twisted shape.

Flow Dynamics in Ancient Latin

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The text to be studied concerns *Cornelii Taciti de origine et situ Germanorum (or Germaniae) liber*, Chap. 44:

[2] *S u i o n u m hinc civitates, ipso in Oceano, praeter viros armaque classibus valent. forma navium eo differt, quod utrimque prora paratam semper appulsui frontem agit. nec velis ministrant nec remos in ordinem lateribus adiungunt: solutum, ut in quibusdam fluminum, et mutabile, ut res poscit, hinc vel illinc remigium.* [3] *est apud illos et opibus honos, eoque unus imperitat, nullis iam exceptionibus, non precario iure parendi. nec arma, ut apud ceteros Germanos, in promiscuo, sed clausa sub custode, et quidem servo, quia subitos hostium incursus prohibet Oceanus, otiosae porro armatorum manus facile lasciviunt: enimvero neque nobilem neque ingenuum, ne libertinum quidem armis praeponere regia utilitas est.*

Alf Önnersfors formulates a traditional characteristic of Tacitus' style in the preface to his translation into Swedish of Tacitus' text (98/1960):

.../ its text building is short and compact, restless and often asyndetic and antithetic. .../ Tacitus refines .../ especially the brevity of expression, which at times makes his production abstruse, .../ (pp. 27-28) [author's translation]

Önnersfors is characterizing a grammar that is unbound in its syntax and complex in its morphology and thus offers several interpretations of the content and message. He thus provides examples of criteria for a style that bears the stamp of the author's personality. The question is whether a geometric description can show the extent to which Tacitus' refinement of the brevity and compactness in the expression has its counterpart in a space-function and whether the method can trace the writer's sensitivity in relation to the environment he wrote about. First, some comments on the preparation of the Latin text for a Vertex-analysis.

Comments on the text analysis

Central to the text handling is the discernment of all string of graphemes that are verbs, because the verb has the function to separate Agent from the Objective. The definition of the verb in a Vertex-analysis is discussed in I. Bierschenk and B. Bierschenk (2011, p. 6). As a verb count finite and infinite forms and participles (which belong to the verb forms, but are used with noun and adjective endings) and also gerundium and gerundivum, which are special Latin forms. A few places in the Latin text need to be clarified. In the middle of line five appears the phrase 'iure parendi'. It has been translated into Swedish as 'rätt till åtlydnad' by N. E. Hammarstedt 1916, and 'rätt till lydnad' by Per Persson 1929, i.e. ('right to obedience'). Persson explains the meaning as 'to become obeyed'. (Both quoted from Martinsson, Tacitus.nu). Önnersfors is using 'rätt att kräva lydnad' ('right to demand obedience'), which is a more active meaning. The form 'parendi' is the conjugation form of Gerundium and thus treated as a verb. On the second last line, 'armatorum manus' has been translated with 'beväpnade män' ('armed men') by Önnersfors and 'hopar av väpnade' ('crowds of armed') by Hammarstedt, while Persson is using the more literal 'beväpnades händer' ('hands of armed'). The form 'armatorum' is treated as a verb.

As is known, a traditional identification of subject and object in a Latin sentence is governed by their inflection and not primarily by their position in relation to the predicate verb. Strictly, a Vertex-analysis builds on the condition that the A-position means before the verb and the O-position means after the verb. It is independent of semantic interpretation, since the Agent component is not the same as subject (studied e.g., in I. Bierschenk, 2011).

The expression ‘est apud illos et opibus honos’ at line four (literally ‘is (has) by them also richness reputation’) has thus an empty A-position, which is indicated by dummy symbol (\emptyset).

When the magnitudes of the variables are computed for input into a graph program, then an empty position immediately at the beginning of a clause (\emptyset_A) or at the end (\emptyset_O) implies that the value entered for the empty variables is zero (0), in case the sentence marker signals the end of a period. However, if the text continues, the overall flow may still give rise to a dynamic whole depending on the values of the filled string rotations. Moreover, as the example below will show, there will be a (\emptyset) which get its value from the rotations of the preceding or following clause, in case a comma or equivalent clause marker signals a border to be crossed. The dummy to be substituted means that the inserted value is a shadow, which is calculated as the root of a material value. The question is therefore whether and to what degree the Latin text presents enough of these empty spaces to guarantee a dynamic flow and thus a living space.

Magnitudes of String Rotation

For illustrative purposes, a sentence from the Latin text shall be used: ‘*forma navium eo differt, quod utrimque prora paratam semper appulsui frontem agit*’ (first two lines). (Literally ‘form of ships therein differs, that on both sides stem prepared always landing front offers’). The boats were pointed at both ends to easily be managed.

The two components (A) and (O) are driven by a movement, similar to a pendulum. Its impact must be asymmetric in order to generate synthesis or meaning. Certain principles are clarified in Table 1.1.

Table 1.1
Magnitudes of string rotation in a Latin sentence

Clause	String	Translation	Count	Messenger ²	Sum Rad ¹
2	forma	form	5	A5	
	navium	of ships	6		
	eo	therein	2		$A_2=4.4902$
	differt	differs	7		$6.28+(0.0628\otimes 7)+0.628$
	\emptyset			O9	$7.3476-(\sqrt{4.9612}+\sqrt{5.2752})$
					$O_2=2.823445$
3	,		1		
	quod	that	4		
	utrimque	at both sides	8	A5	
	prora	stem	5		$A_3=4.9612$
	paratam	prepared	7	O5	
	semper	always	6		
	appulsui	landing	8		
	frontem	the front	7		$O_3=5.2752$
4	*				
	\emptyset			A8	$5.5-(\text{ROT}(4.9612))$
					$A_4=3.272625$
	agit	offers	4		$0.314+(0.0314\otimes 4)=0.4396$
	\emptyset				0.00
	.			O1	$0.314+(0.0314\otimes 1)=0.3454$
					$O_4=0.785$

¹Hestenes (1986/1993, p. 75) emphasises that the exponential function and its series expansion requires that the angles are measured in radians: [arc $\alpha = 2 \pi (i \phi / 360)$] and [arc $\beta = 2 \pi (\theta \text{ in } / 360)$].

²The baseline values are nine per component A and O and are detected by the pattern of the Messengers.

Repeated textual segments, marked through copies, become coupled on the vertical axis. Vertical coupling is a mark of spiralling structure as well as an indication of an evolving configuration, which is the result of a “winding factor” (Winfree, 1980, pp. 14, 244). Winding (W) in the strings of graphemes is calculated with the base value ($W=1/1$). This is a virtual rotation. On the physical level, however, the rotation includes variables in the form of words whose magnitude is defined with ($W=1/10$). This value will be added to the base. On the material level, the magnitude of the graphemes is defined with ($W=1/100$). At this level, the graphemes are counted and the count is used for multiplication. A closer investigation into the calculation principle together with empirical results may be found in, e.g., B. Bierschenk (2001a) and I. Bierschenk and B. Bierschenk (2011). An illustrative example follows below.

To obtain the string rotations of each component (e.g., *forma navium eo*) we count first the graphemes of a string and calculate the value ($0.0314 \otimes 5$) and add the value for the component string (0.314). The next following string rotations are calculated in the same way. Finally we add the base value (3.14) and the summation of the rotation in the A-component is shown at the right ($=4.4902$).

The example of Table 1.1 shows that a placeholder may signal that the roots are to be found in another clause. Such a case occurs in the second clause. To calculate we take the base value of the placeholder, add the value of the verb and add the sums of A5 and O5. Thereafter we detract the root of these sums from the value of the placeholder, which give a final rotation value of ($=2.823445$). This means that the value of an intangible (shaded) string of graphemes has been retrieved. The variable notations provide the basis for the x-axis of the potential energy surfaces.

Potential Energy Surfaces

The magnitudes of the string rotations make the morphogenetic properties apparent, which lead to the generation of time-dependent trajectories. At first, it would seem unlikely, that a separation of the A- from the O-component would lead to comprehensible results. However, testing the effects of separation will be studied with the following strategy. In a first step (1), the Intention space of the A-component is developed followed by a second step (2), where the Orientation space of the O-component is developed.

At a first glance, this strategy may seem to destroy the strict dependency, i.e., their spinal chord. However, if this separation would lead to the establishment of a bi-componential disparity of intention and orientation, this would be seen to be a very radical test on the validity of the AaO-approach (Greene, 1999, p. 278).

Shadings around some preferred phase relations (italics in Tab. 1.1) are demonstrating the kind of change that can be determined within and between the periods and the fractions of a period that are critical in the production of a particular text. For this reason, it is quite natural that the spectrum of a space must take into account the way in which the variables of the components are sliding over the intervals (marked with comma and full stop in Tab 1.1).

In producing intervals through its own internal processes, text production is gating itself in its structural development, and consequently its self-organising tendencies. Hence, periods and fractions of periods are determining the intrinsic system of coordinates and the involved transition. Generated intervals have been identified as the fundamental control parameter, which is governing the timing of information synthesising processes at the ecological level. In studying the outcomes of this clockwork from a kinematic point of view, an attempt is made to describe the theoretical significance of the resulting morphological configurations. It follows that the subject matter in the present study concerns the shape of temporal morphologies.

Fully analysed, the text is entered into a graphing program (here SigmaPlot, version 11, 2008). The two components, demonstrated in Table 1.1, have been split into separate graphs.

The variables (α) of the A-cases and the variables (β) of the O-cases are entered into the order of the x-axis while the y-axis indicates the number of time intervals. As illustrated in Table 1.1, an interval is delimited by punctuation marks and must include at least one verb. The z-axis indicates the magnitudes, which are governing the development of the graphs of Intention, shown in Figure 1.1 and Orientation, shown in Figure 1.2.

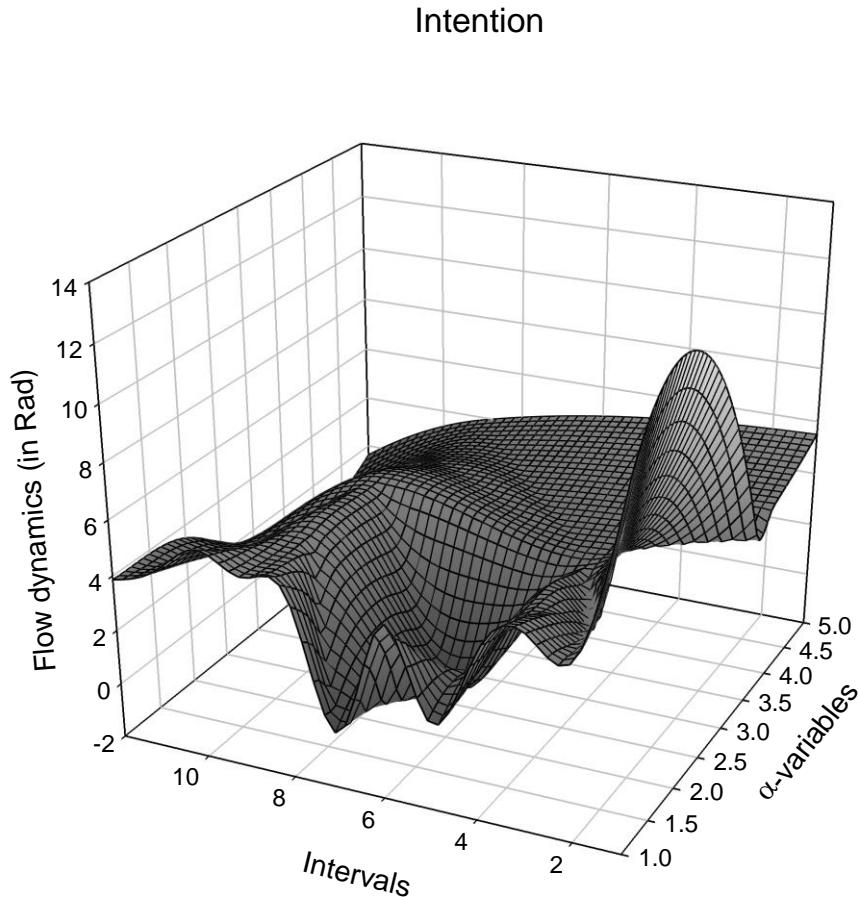


Figure 1.1 *Flow dynamics of the Agent*

The graph shows how the text will look like when its production is transformed to a geometric shape. We thus get a three dimensional image of text development of the agent and a complementary picture of the development of the objective. The graph presents the text as a piece of billowing fabric, which is a visualisation of what texture is.

Comments to the reading of a graph: The loading of the data has been done from left to right, as in ordinary natural reading. This means that the reading of the textual flow dynamics must be done from the right instead. On the x-axis, the drift is shown that marks the progression. The proliferation, read off the y-axis, is coordinating the direction in time with the thermodynamic processes. Speed and acceleration is expressed by the radians on the z-axis. Note that the program has converted the textual intervals into a scale.

The Agent surface

First, we study the intentional flow dynamics of (A) and compare some of the asymmetries in this sequencing space with corresponding places of textual articulation. In the first interval appears the maximum rotation value, observed as a strong and rapidly inflated wave crest. This is accomplished through the first explicitly expressed agent variable, which

is made up of specifications before the verb (*Suionum ... classibus*). Its magnitude is (≈ 10.91). A fold is formed after the next interval, which implies a lower rotation value (≈ 4.49). Hence, this agent variable (*forma navium eo*) is less prominent. Moreover, the shape is slightly undulating, which means that the values are rotating evenly.

Towards the middle of the text, it reveals a slower movement that seems to suck the texture down. A closer look reveals that in the fifth interval and before the verb form (\emptyset *solutum*) a deeper fold (≈ 1.15) is visible. Here, the flow is dependent on the agent (*nec velis*). Since it is copied, which is sliding over two clause markers, the root has been extracted twice. The deepest tip is in the seventh interval and is the result of a dummy variable. It marks a totally non-integrated agent (X), which cannot be replaced by the value of a preceding agent due to the A-position, which is the beginning of the sentence (\emptyset *est apud illos...*). It is also emphasised in the text that a new paragraph begins here. This place serves as a temporary flow stop (magnitude=0). A deep is further present in the last interval (≈ 1.18), which you need to imagine, because it is hidden behind the last tab at the left in the graph.

According to Önnersfors as well as many others who have commented on Tacitus' writing manners, characteristic is its epigrammatic terseness and vividness. One such example can be found at the very beginning through the verbless phrase (*Suionem hinc civitates, ...*). Thus, the first lively agent may be perceived as an example of a rhetorically elegant way of introducing a topic, which serves as a prelude and allows the reader to take the writer's position (e.g., And now to the communities of the Suiones ...). A control in some official European translations of this passage show that only the French and the English versions are following this expression truly and that in the Italian, German, Swedish, and Danish, a verb has been inserted.

Concerning Tacitus' environmental sensitivity, (*Nec velis*) emerges as the most significant motion in the agent flow, i.e., the Suiones do *not* have *sails* on their boats. In the last paragraph, he notes that *not even (ne)* a freeman is allowed to be in charge of the weapons (it can only be a slave). The importance of the agents for the overall perspective structure can only emerge through the analysis of the folded formation, which is another step in the graphical representation and refers to a landscape based on a Free Energy Surface (see next chapter). Now, let us look into the flow dynamics of the Orientation space, Figure 1.2.

The Objective surface

The first deepness occurs in the first interval, which means that the verb is followed by a dummy variable for the textual objective (*valent* \emptyset .). The magnitude of the dummy is very close to zero (≈ 0.84), which contains the value of the grapheme strings of the verb together with the value of word and sentence marker. However, no root can be extracted, because the flow stops. Next deep is marked with (≈ 0.78). It is similarly formed by the verb (*agit* \emptyset .), which appears in the third interval and likewise is followed by a temporary flow stop. The deepest part of the text carries the magnitude (≈ 3.72) and can be observed in the fourth interval due to (*adiungunt* \emptyset : .). At this place, the articulation has resulted in a rotating and swinging objective. It is composed of both the shaded agent (*nec velis*), which through the dummies is channelled downwards from the fourth to the fifth interval, and of the phrase (*ut in quibusdam fluminum*), whose roots are extracted in reversed order from the fifth to the fourth interval.

In the seventh interval, the highest value shows up, namely (≈ 7.15). It refers to the place in the flow where (*est apud illos et opibus honos...*) is starting a new sentence and no roots are modifying the objective value. In the last interval, we have a low value (≈ 0.75), which is the end of the text.

Orientation

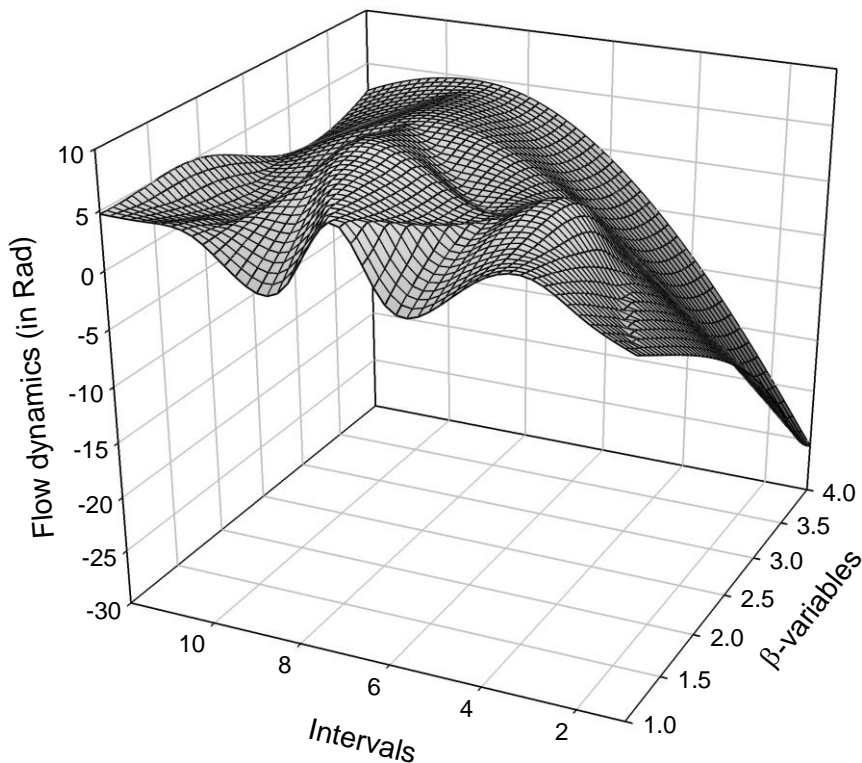


Figure 1.2 *Flow dynamics of the Objective*

It has been indicated through the darker parts of the lot behind the last fold. Further, in the fifth, sixth, eighth, ninth, and twelfth intervals, low values imply some restricted moves. Obviously, the variables of the Objective do not flow evenly. Instead, the flow shows a twisted and knotted shape, which may be said to resemble a clam or snail. The twist in the shape namely is caused by both the twinning and twisting rotations around the verb (*adjungunt*) in the fourth interval and (*solutum*) in the fifth. These verbs refer to the fact that the Suiones do not connect (attach) oars at the sides of the boat, but let them be detached as in some rivers (*ut in quibusdam fluminum*).

Conclusions: The usual conception of Tacitus' style has been confirmed by the geometric representation of the short text passage. Furthermore, it has been possible to differentiate between the writer's perspective on the subject and his orientation in the subject by the different but complementary geometric shapes of the Agent and the Objective component. The *Agent* shape shows rapid and explicit writing movements, which seem to be rhetorically controlled; the prelude comes first, thereafter the sensitive motions, governing the flow. The *Objective* gives a picture of a writer who treats his subject in a restrained manner. Is this shape an expression of tacit knowledge? Anyway, there are reasons to call the writer "closed". Finally, its structural significance is addressing the fact that free parameters are pointless in the string-approach (Greene, 1999, p. 383) and means that this approach is not fitted into one or the other empirical context. Hence, for the first time it has been possible to look into the language space of a Latin text and to measure the phenomenon of consciousness in behavioural terms and in an Ancient context.

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